

WHAT IS CLAIMED IS

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1. An optical recording method for an optical storage medium in which a recording pulse pattern having a sequence of multiple pulses is used to record one of plural kinds of marks with different lengths on the storage medium through a recording process in which  
10 a recording linear velocity is variable, comprising the steps of:

allocating individually two or more discrete write powers to the respective pulses of the recording pulse pattern;

linearly varying each of the write powers, allocated to the respective pulses of the recording pulse pattern, in proportion with a  
15 change of one of the recording linear velocity and a recording position of the storage medium; and

supplying the recording pulse pattern to a pickup, the pickup emitting a light beam to the storage medium in accordance with the recording pulse pattern having the linearly varied write powers  
20 allocated to the respective pulses, so that one of the plural kinds of marks is recorded on the storage medium.

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2. An optical recording method for an optical storage medium in which a recording pulse pattern having a sequence of multiple pulses is used to record one of plural kinds of marks with different lengths on the storage medium through a CAV or ZCAV recording process wherein the recording angular velocity is constant,  
5 comprising the steps of:

allocating individually two or more discrete write powers to the respective pulses of the recording pulse pattern;

linearly varying each of the write powers, allocated to the  
10 respective pulses of the recording pulse pattern, in proportion with a change of one of a recording linear velocity and a recording position of the storage medium; and

supplying the recording pulse pattern to a pickup, the pickup emitting a light beam to the storage medium in accordance with the  
15 recording pulse pattern having the linearly varied write powers allocated to the respective pulses, so that one of the plural kinds of marks is recorded on the storage medium.

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3. The optical recording method of claim 1, wherein a multi-pulse recording scheme is performed by selecting one of two or more sequences of multiple pulses, each sequence including a  
25 predetermined number of the pulses, to record a specific one of the

plural kinds of marks with the different lengths on the storage medium.

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4. The optical recording method of claim 2, wherein a multi-pulse recording scheme is performed by selecting one of two or more sequences of multiple pulses, each sequence including a  
10 predetermined number of the pulses, to record a specific one of the plural kinds of marks with the different lengths on the storage medium, and the recording pulse pattern is optimized to a maximum recording linear velocity of the storage medium.

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5. The optical recording method of claim 3, wherein, in said allocating step, the recording pulse pattern is optimized to a  
20 maximum recording linear velocity of the storage medium, and the allocation of the write powers is performed such that the write powers allocated to the respective pulses of a first sequence selected from said two or more sequences for a minimum-length mark among the plural kinds of marks are lower than a maximum of the write  
25 powers allocated to the pulses of the remaining sequences other than

the first sequence.

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6. The optical recording method of claim 3, wherein, in said allocating step, the recording pulse pattern is optimized to a maximum recording linear velocity of the storage medium, and the allocation of the write powers is performed such that the write power allocated to a top pulse of the pulses of a first sequence selected from said two or more sequences for a minimum-length mark among the plural kinds of marks is lower than or equal to a maximum of the write powers allocated to the pulses of the remaining sequences other than the first sequence.

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7. The optical recording method of claim 3, wherein, in said allocating step, the recording pulse pattern is optimized to a maximum recording linear velocity of the storage medium, a first sequence of the pulses, selected from said two or more sequences for a minimum-length mark among the plural kinds of marks, consisting of a top pulse and a last pulse, and each of second sequences of the pulses, other than the first sequence, consisting of a top pulse, a last

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pulse and at least one middle pulse, and wherein the allocation of the write powers is performed such that the write power allocated to the top pulse of the first sequence is lower than a maximum of the write powers allocated to the pulses of the second sequences, and  
5 that the write power allocated to the last pulse of the first sequence and the respective write powers allocated to the pulses of each second sequence are equal.

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8. The optical recording method of claim 3, wherein, in said allocating step, the recording pulse pattern is optimized to a maximum recording linear velocity of the storage medium, a first  
15 sequence of the pulses, selected from said two or more sequences for a minimum-length mark among the plural kinds of marks, consisting of a top pulse and a last pulse, and each of second sequences of the pulses, other than the first sequence, consisting of a top pulse, a last pulse and at least one middle pulse, and wherein the allocation of  
20 the write powers is performed such that the write power allocated to the top pulse of the first sequence is lower than or equal to a maximum of the write powers allocated to the pulses of the second sequences, and the write power allocated to the top pulse of the first sequence is lower than the write power allocated to the last pulse of  
25 the first sequence, and the write power allocated to the last pulse of,

the first sequence and the respective write powers allocated to the top pulse and said at least one middle pulse of each second sequence are equal.

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9. The optical recording method of claim 3, wherein, in said allocating step, the recording pulse pattern is optimized to a maximum recording linear velocity of the storage medium, a first sequence of the pulses, selected from said two or more sequences for a minimum-length mark among the plural kinds of marks, consisting of a top pulse and a last pulse, and each of second sequences of the pulses, other than the first sequence, consisting of a top pulse, a last pulse and at least one middle pulse, and wherein the allocation of the write powers is performed such that the write power allocated to the top pulse of the first sequence is lower than a maximum of the write powers allocated to the pulses of the second sequences, the write powers allocated to the top pulse and the last pulse of the first sequence are equal to each other, and all of the respective write powers allocated to the top pulse, the last pulse and said at least one middle pulse of each second sequence are equal.

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10. The optical recording method of claim 3, wherein, in said allocating step, the recording pulse pattern is optimized to a maximum recording linear velocity of the storage medium, a first sequence of the pulses, selected from said two or more sequences for  
5 a minimum-length mark among the plural kinds of marks, consisting of a top pulse and a last pulse, and each of second sequences of the pulses, other than the first sequence, consisting of a top pulse, a last pulse and at least one middle pulse, and wherein the allocation of the write powers is performed such that the write power allocated to  
10 the top pulse of the first sequence is lower than or equal to a maximum of the write powers allocated to the pulses of the second sequences, the write powers allocated to the top pulse and the last pulse of the first sequence and the write power allocated to the last pulse of each second sequence are equal to each other, and the write  
15 power allocated to the last pulse of the second sequence is lower than the respective write powers allocated to the top pulse and said at least one middle pulse of the second sequence.

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11. The optical recording method of claim 3, wherein, in said allocating step, the recording pulse pattern is optimized to a maximum recording linear velocity of the storage medium, a first  
25 sequence of the pulses, selected from said two or more sequences for

a minimum-length mark among the plural kinds of marks, consisting of a top pulse and a last pulse, and each of second sequences of the pulses, other than the first sequence, consisting of a top pulse, a last pulse and at least one middle pulse, and wherein the allocation of

5 the write powers is performed such that the write power allocated to the top pulse of the first sequence is lower than or equal to a maximum of the write powers allocated to the pulses of the second sequences, the write powers allocated to the top pulse and the last pulse of the first sequence and the write power allocated to said at

10 least one middle pulse of each second sequence are equal to each other, and the write power allocated to said at least one middle pulse of the second sequence is lower than the respective write powers allocated to the top pulse and the last pulse of the second sequence.

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12. The optical recording method of claim 3, wherein, in said allocating step, the recording pulse pattern is optimized to a

20 maximum recording linear velocity of the storage medium, a first sequence of the pulses, selected from said two or more sequences for a minimum-length mark among the plural kinds of marks, consisting of a top pulse and a last pulse, and each of second sequences of the pulses, other than the first sequence, consisting of a top pulse, a last pulse and at least one middle pulse, and wherein the allocation of

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the write powers is performed such that the write power allocated to the top pulse of the first sequence is lower than or equal to the write powers allocated to a maximum of the write powers allocated to the pulses of the second sequences, the write powers allocated to the top pulse and the last pulse of the first sequence and the write power allocated to the top pulse of each second sequence are equal to each other, and the write power allocated to the top pulse of the second sequence is lower than the respective write powers allocated to said at least one middle pulse and the last pulse of the second sequence.

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13. An optical recording apparatus for an optical storage medium in which a recording pulse pattern having a sequence of multiple pulses is used to record one of plural kinds of marks with different lengths on the storage medium through a recording process wherein a recording linear velocity is variable, comprising:

a write power allocation unit allocating individually two or more discrete write powers to the respective pulses of the recording pulse pattern;

a write power control unit linearly varying each of the write powers, allocated to the respective pulses of the recording pulse pattern by the write power allocation unit, in proportion with a change of one of the recording linear velocity and a recording

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position of the storage medium; and

5 a recording pulse pattern supply unit supplying the recording pulse pattern, output by the write power control unit, to a pickup, the pickup emitting a light beam to the storage medium in accordance with the recording pulse pattern having the linearly varied write powers allocated to the respective pulses, so that one of the plural kinds of marks is recorded on the storage medium.

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14. An optical recording apparatus for an optical storage medium in which a recording pulse pattern having a sequence of multiple pulses is used to record one of plural kinds of marks with different lengths on the storage medium through a CAV or ZCAV recording process wherein the recording angular velocity is constant, comprising:

15 a write power allocation unit allocating individually two or more discrete write powers to the respective pulses of the recording pulse pattern;

20 a write power control unit linearly varying each of the write powers, allocated to the respective pulses of the recording pulse pattern by the write power allocation unit, in proportion with a change of one of a recording linear velocity and a recording position of the storage medium; and

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a recording pulse pattern supply unit supplying the recording pulse pattern, output by the write power control unit, to a pickup, the pickup emitting a light beam to the storage medium in accordance with the recording pulse pattern having the linearly varied write powers allocated to the respective pulses, so that one of the plural kinds of marks is recorded on the storage medium.

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15. The optical recording apparatus of claim 13, wherein a multi-pulse recording scheme is performed by selecting one of two or more sequences of multiple pulses, each sequence including a predetermined number of the pulses, to record a specific one of the plural kinds of marks with the different lengths on the storage medium.

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16. The optical recording apparatus of claim 14, wherein a multi-pulse recording scheme is performed by selecting one of two or more sequences of multiple pulses, each sequence including a predetermined number of the pulses, to record a specific one of the plural kinds of marks with the different lengths on the storage

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medium, and the recording pulse pattern is optimized to a maximum recording linear velocity of the storage medium.

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17. The optical recording apparatus of claim 13, wherein, in said write power allocating unit, the recording pulse pattern is optimized to a maximum recording linear velocity of the storage medium, and said write power allocation unit performs the allocation of the write powers such that the write powers allocated to the respective pulses of a first sequence selected from said two or more sequences for a minimum-length mark among the plural kinds of marks are lower than a maximum of the write powers allocated to the pulses of the remaining sequences other than the first sequence.

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18. The optical recording apparatus of claim 13, wherein, in said write power allocating unit, the recording pulse pattern is optimized to a maximum recording linear velocity of the storage medium, and said write power allocation unit performs the allocation of the write powers such that the write power allocated to a top pulse of the pulses of a first sequence selected from said two or

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more sequences for a minimum-length mark among the plural kinds of marks is lower than or equal to a maximum of the write powers allocated to the pulses of the remaining sequences other than the first sequence.

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19. The optical recording apparatus of claim 13, wherein, in  
10 said write power allocating unit, the recording pulse pattern is optimized to a maximum recording linear velocity of the storage medium, a first sequence of the pulses, selected from said two or more sequences for a minimum-length mark among the plural kinds of marks, consisting of a top pulse and a last pulse, and each of  
15 second sequences of the pulses, other than the first sequence, consisting of a top pulse, a last pulse and at least one middle pulse, and wherein said write power allocation unit performs the allocation of the write powers such that the write power allocated to the top pulse of the first sequence is lower than a maximum of the write  
20 powers allocated to the pulses of the second sequences, and that the write power allocated to the last pulse of the first sequence and the respective write powers allocated to the pulses of each second sequence are equal.

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20. The optical recording apparatus of claim 13 wherein, in  
said write power allocation unit, the recording pulse pattern is  
optimized to a maximum recording linear velocity of the storage  
medium, a first sequence of the pulses, selected from said two or  
5 more sequences for a minimum-length mark among the plural kinds  
of marks, consisting of a top pulse and a last pulse, and each of  
second sequences of the pulses, other than the first sequence,  
consisting of a top pulse, a last pulse and at least one middle pulse,  
and wherein said write power allocation unit performs the allocation  
10 of the write powers such that the write power allocated to the top  
pulse of the first sequence is lower than or equal to a maximum of  
the write powers allocated to the pulses of the second sequences, and  
the write power allocated to the top pulse of the first sequence is  
lower than the write power allocated to the last pulse of the first  
15 sequence, and the write power allocated to the last pulse of the first  
sequence and the respective write powers allocated to the top pulse  
and said at least one middle pulse of each second sequence are equal.

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21. The optical recording apparatus of claim 13, wherein, in  
said write power allocation unit, the recording pulse pattern is  
optimized to a maximum recording linear velocity of the storage  
25 medium, a first sequence of the pulses, selected from said two or

more sequences for a minimum-length mark among the plural kinds  
of marks, consisting of a top pulse and a last pulse, and each of  
second sequences of the pulses, other than the first sequence,  
consisting of a top pulse, a last pulse and at least one middle pulse,  
5 and wherein said write power allocation unit performs the allocation  
of the write powers such that the write power allocated to the top  
pulse of the first sequence is lower than a maximum of the write  
powers allocated to the pulses of the second sequences, the write  
powers allocated to the top pulse and the last pulse of the first  
10 sequence are equal to each other, and all of the respective write  
powers allocated to the top pulse, the last pulse and said at least one  
middle pulse of each second sequence are equal.

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22. The optical recording apparatus of claim 13, wherein, in  
said write power allocation unit, the recording pulse pattern is  
optimized to a maximum recording linear velocity of the storage  
20 medium, a first sequence of the pulses, selected from said two or  
more sequences for a minimum-length mark among the plural kinds  
of marks, consisting of a top pulse and a last pulse, and each of  
second sequences of the pulses, other than the first sequence,  
consisting of a top pulse, a last pulse and at least one middle pulse,  
25 and wherein said write power allocation unit performs the allocation.

of the write powers such that the write power allocated to the top pulse of the first sequence is lower than or equal to a maximum of the write powers allocated to the pulses of the second sequences, the write powers allocated to the top pulse and the last pulse of the first  
5 sequence and the write power allocated to the last pulse of each second sequence are equal to each other, and the write power allocated to the last pulse of the second sequence is lower than the respective write powers allocated to the top pulse and said at least one middle pulse of the second sequence.

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23. The optical recording apparatus of claim 13, wherein, in  
15 said write power allocation unit, the recording pulse pattern is optimized to a maximum recording linear velocity of the storage medium, a first sequence of the pulses, selected from said two or more sequences for a minimum-length mark among the plural kinds of marks, consisting of a top pulse and a last pulse, and each of  
20 second sequences of the pulses, other than the first sequence, consisting of a top pulse, a last pulse and at least one middle pulse, and wherein said write power allocation unit performs the allocation of the write powers such that the write power allocated to the top pulse of the first sequence is lower than or equal to a maximum of  
25 the write powers allocated to the pulses of the second sequences, the



write powers allocated to the top pulse and the last pulse of the first  
sequence and the write power allocated to said at least one middle  
pulse of each second sequence are equal to each other, and the write  
power allocated to said at least one middle pulse of the second  
5 sequence is lower than the respective write powers allocated to the  
top pulse and the last pulse of the second sequence.

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24. The optical recording apparatus of claim 13, wherein, in  
said write power allocation unit, the recording pulse pattern is  
optimized to a maximum recording linear velocity of the storage  
medium, a first sequence of the pulses, selected from said two or  
15 more sequences for a minimum-length mark among the plural kinds  
of marks, consisting of a top pulse and a last pulse, and each of  
second sequences of the pulses, other than the first sequence,  
consisting of a top pulse, a last pulse and at least one middle pulse,  
and wherein said write power allocation unit performs the allocation  
20 of the write powers such that the write power allocated to the top  
pulse of the first sequence is lower than or equal to the write powers  
allocated to a maximum of the write powers allocated to the pulses  
of the second sequences, the write powers allocated to the top pulse  
and the last pulse of the first sequence and the write power allocated  
25 to the top pulse of each second sequence are equal to each other, and

the write power allocated to the top pulse of the second sequence is lower than the respective write powers allocated to said at least one middle pulse and the last pulse of the second sequence.

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